



Exploring children's environments



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Sciences

Environmental settings seem to influence the activity patterns of children and youth in their leisure time. New technology can be supportive in describing the relations between the user and the affordance of the environments. Through several studies we have explored the technology of GPS for spatial locations of children's movement patterns in different landscapes. This made it possible to identify habitats for different kinds of play and landscape structures that afforded specific functions, for example balance, climbing, jumping, sliding, and rolling. Such structures were identified and mapped as determinants for physical activity (PA) and motor development. A further step to explore physical activity and landscape use was to use a mobile GPS combined with heart rate monitoring using the Garmin Forerunner 305. This made it possible to localize environments and physical activity simultaneously. It is possible to identify both the place and intensity of PA using the Garmin Forerunner 305. The data from the Forerunner 305 units were downloaded using Garmin Training Center and exported as history files (TCX format), flattened into a combined plain text table using a custom shell script and a Java programme. The plain text table was imported into PostGIS/PostgreSQL (using Unix tools) and ArcMap (using the tool «Add XY data»). For visual data mining of the space-time GPS + heart rate data, Google Earth was used. The data were prepared for Google Earth timeline by creating a KML file with time stamped (TimeSpan) linestrings using a custom made Java programme. In order to

be able to show the activity levels in the animations, each linestring connected the positions of two consecutive observations and was styled according to the heart rate level of these observations. Aggregation of data for analysis was done using Python programmes and PostGIS. Three main ways of aggregating data were tested. For statistical analysis, a regular grid has its merits, and was used in the end. Cell sizes of 10 meters by 10 meters and 100 meters by 100 meters were created. For the landscape analysis the 10 meter cell size was needed to capture the necessary amount of detail. The positioning accuracy was deemed sufficient for aggregation to this cell size. For all the cells, heart rate and time spent in the cells were aggregated in various ways using the real sampling intervals of the Forerunner 305.

The approaches to our latest project are landscape qualities and affordances for free-living activity in young people, what kind of landscape elements stimulate physical activity and how active are adolescents in their neighbourhood environments? The methodological approach is application of GPS, HR monitoring and implementation in GIS. The first article from the project based on schoolyard physical activity has been published (*Scandinavian Journal of Public Health*, 38(Suppl 5): 28-37). The project schedule will include articles on applied methodology of GPS combined with heart monitoring implemented in GIS, landscape analyses explaining localities for free-living activities and identification of environments for physical activity at different intensity levels.



Note from the editor

Hello everyone

Earlier this year, I was fortunate to be able to attend the 2011 Active Living Research conference in San Diego. I was particularly enthused by the interaction with fellow researchers in the GPS workshop coordinated by Dr Jacqueline Kerr, Dr Jasper Schipperijn, Dr Frederic Raab and myself. There are quite a few of us out there that are using or thinking of using GPS; this is reflected in the growing membership of the GPS-HRN (we have reached 155 members from 22 countries).

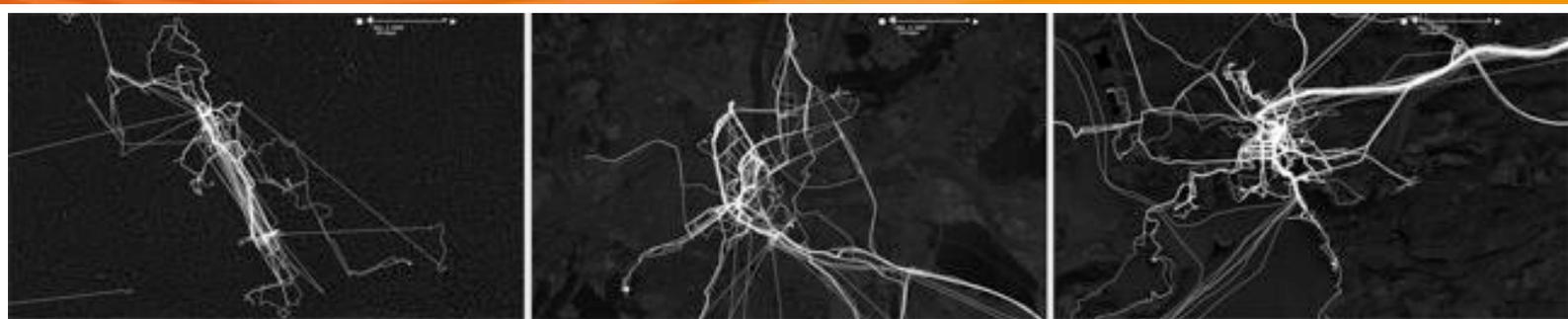
In this issue of the GPS-HRN newsletters we have some outstanding contributions from our members. Assoc Prof Ingunn Fjørtoft describes her work investigating children's environments. In addition, Fabian Neuhaus has contributed two related articles about the UrbanDiary initiatives in London and Basel.

Looking ahead, will be organizing a gathering of the GPS-HRN at the upcoming Annual Meeting of the International Society of Behavioural Nutrition and Physical Activity in Melbourne. We will meet in Room 103 on Thursday June 16 at 12:30pm. This is an excellent opportunity to reflect on the growth of the GPS-HRN and to plan ahead for the future. See page 4 for more details.

As always, if you come across any GPS-related news, updates, or recent publications, please don't hesitate to post them on the website.

All the best

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UrbanDiary – GPS and the Spatial Habitus



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UrbanDiary London

As part of the UrbanDiary project (urbantick.blogspot.com), a GPS tracking study into the rhythms and routines of the everyday activities of citizens was undertaken. The technology combines the two major interests of the project time and space. The project utilised GPS wristwatch devices to record the individual journeys and spatial habits of twenty volunteers in order to capture and trace their lived experiences of the city. The data collected included exact time and location, which enabled each trip by an individual to be plotted on a base map of the city and visualised as a 'personal track', building up a personal context map of the city.

Traditionally we are thinking of the city as a network of streets, buildings and blocks forming an overall space, leaving the voids for circulation in the streets. Within this box-like construction of space-time, movement and change are treated as placed attributes. Movement and change are not employed in the construction of the box because they, unlike the physical elements of the city, have not one state but many. The UrbanDiary (UD) project aims to address this problem of "many states at the same time" by examining techniques and methodologies to observe and map the change of movement and time directly. The viewpoint adopted is from within the given, but insofar as this project combines aspects of process into the overall description of urban space by tracking activities, it aims to generate new perspectives on how to define and interpret the city as a collective product of patterns in time.

This study is specifically looking at the route chosen between locations and the pattern of repetition occurring through rhythmic schedules over varying periods of time. As the first stage of data collection, a sample of 20 volunteers was equipped with a GPS device (Garmin Foretrex 201) that allowed their journeys through the city to be tracked. Over a period of at least two months, participants recorded their personal spatial diary, mapping the extension of their personal everyday life in space and time. In-depth interviews were used to record contextual information focusing on individual routines and habits.

In order to augment the technical tracking data the study used interviews and mental map to gain information about the individual travel behaviors in term of orientation and navigation. Mental mapping is not a new method but rather a well established way to investigate spatial memory and perception of individuals. One of the most cited studies using mental maps is "The Image of the City" by Kevin Lynch. The study was carried out over five years and in his 1960 book, Lynch states: "Every citizen has had long associations with some parts of his city, and his image is soaked in memories and meanings".

In the UD interview, participants were asked to sketch a mental map to allow participants to express how they navigate the space of the city. In addition to the technical GPS record, this personal view focuses on the participants' perceptions of space based on memory, experience, circumstances and current concerns. Through the comparison of the two different maps, new insights into people's

motivations for choosing a route, and individual methods of orientation, can be explored.

What can be observed in most of the examples is a very specific time distortion in terms of how individuals remember the journey and how they draw it, in comparison to the GPS traced real world equivalent. Especially between the different modes great variety can be found. For example, between journeys by bus and journeys walked on foot, the aspect of engagement is dramatically different. Comparing the length of both modes as expressed in the mental map to the GPS record, it is clearly visible that the length of the bus journey is a lot shorter in the mental map than it is in the GPS reference. On the other hand, the walked part is represented in a lot more detail in the mental map than the bus journey. This suggests that the perception of space changes with time, mode of transport and especially with speed. Less detail is registered by some commuters on the bus as they "know" the route and focus on the destination. Some of the participants have explicitly stated in the interview that on the bus they ignore the route and concentrate on a book, the music playing through their headphones or simply just sit and look out the window not registering much detail. This leaves them with little knowledge that could be retrieved later and used to describe the journey.

Despite differences in transport modes, the structuring element of routine is very present in all the records even surprising the
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(cont) participants themselves. It appears that often participants have a different perception of their spatial habits, and will describe them at the beginning of the tracking as diverse and spread over a large area of the city. The first few times they see the collected data, it can be disappointing for them to see a rather strong routine. Routine seems to be negatively perceived and participants often present themselves as active, flexible and spontaneous, implying a widely spread range of activities with a diverse movement pattern. This phenomenon might have its origin in the modernist ideal conceptualisation of space and movement. It could be interpreted as a late descendent of the illusion of the automatic and autonomous freedom that played an important part in modernist spatial concepts and encapsulated by positive feelings about the beauty of the machine and the associated freedom newly-inherited by the middle class. As Alistair Bonnett in his 2000 essay 'Buses' puts it "Thus 'ordinariness' and 'everydayness' are maintained as the provinces of the working class, ...".

A trajectory map results from connecting these points with lines. These trajectory lines represent what is assumed to be the line of movement. The line of movement is to some extent a direct descendant of the given physical morphology of the city. The pattern that emerges from collective activity, in the case of London star shaped, is therefore directly related to the structure of the cities infrastructure layout. Compared to records of other cities, this characteristic

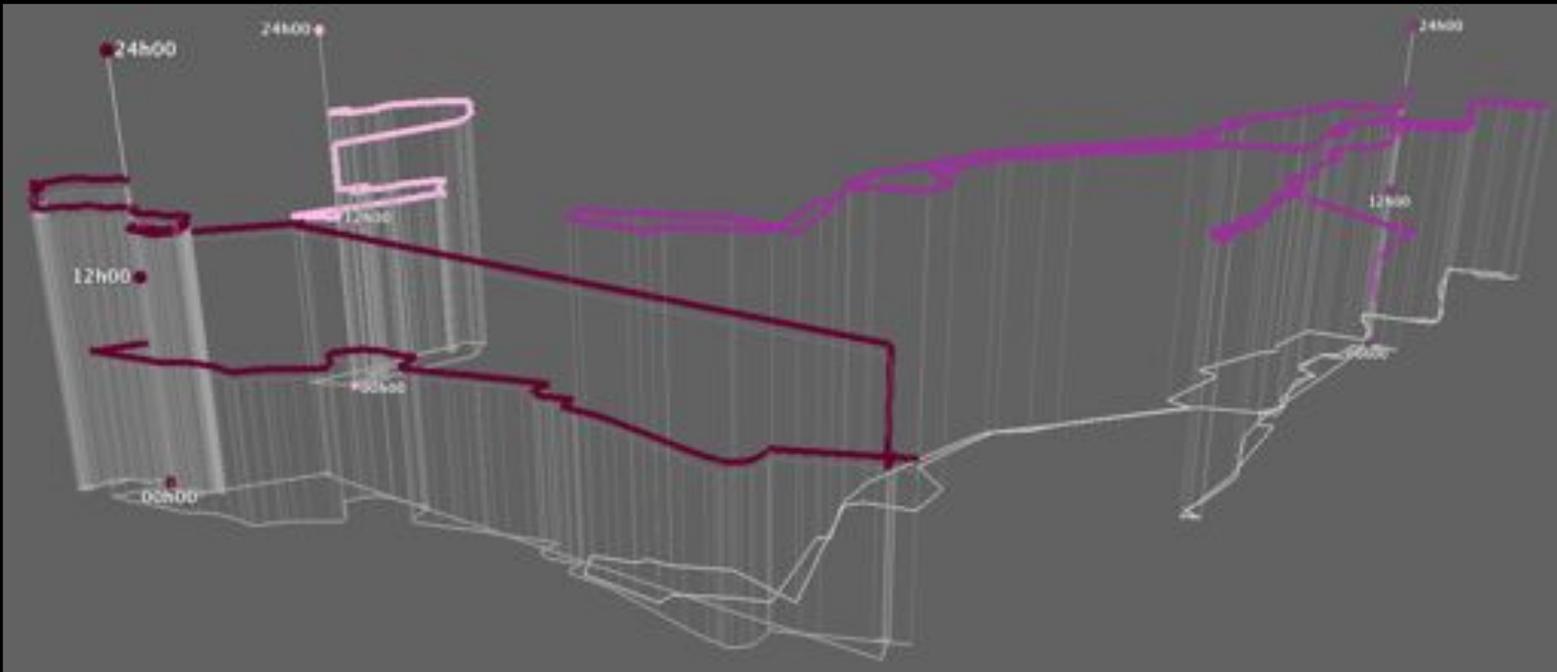
may be individual to each city and is determined mainly by the morphology, transport network and citizen behavior. This, however, also transfers to the individual participant and they all draw individual types of trail sets over the recording period. The shape and extend of this can be characterized by the routines and habits, but as seen earlier also by preferences and of course the relative location of important places.

Depending on the participant's transport preferences, the emerging pattern of activity either draws a continuous track or starts to build up isolated and spatially disconnected areas. One major factor to influence this pattern of detached locations is the individual's chosen mode of transport, which in the case of London may involve using the tube. Comparing two participants with different user pattern shows the characteristic of connectedness and islandification. One participant mainly uses the bus tracing a continuous line linking visually across from one location to the next. Guy Debord examined and defined the phenomenon of the city islands as isolated and spatially disconnected areas in his Naked City text (1959) and challenged traditional ideas of, by dramatically departing from the grid and introducing a fragmented, subjective and temporal perspective summarized with the term psychogeography. The experience of the UrbanDiary project suggests that the emergent pattern is also connected to people's personal preferences. Some of the participants would never use the tube for personal reasons and others would always

use the tube for the same reasons. Often the argument is about the sense of orientation that participants associate with the particular mode of transport, e.g. the 'simplicity' of the London tube map or the 'simplicity' of the surface bus route.

Another method to represent time and location simultaneously was developed in the 1970's by Torsten Hagerstrand (1978). The model produces a 3D visualisation of the data, using the x- and y-dimensions to refer to the spatial location of events and the vertical z-dimension to plot the passage of time. This space-time 'aquarium' comfortably merges the two different types of information. The approach was also implemented successfully in work done by Kwan, summarised in GIS Methods In Time-Geographic Research (2004). In the aquarium plot of three participants from London the different activity pattern over a 24 hours period on a Saturday are very adequately visualized.

These different types of visualization help to investigate the location-time tagged data collected. One of the unexpected findings emerged from a comparison of the different visualization. The time spent interacting with the urban morphology, for example, by moving about in the city, is rather restricted. Also there are clearly defined timeframes and an overall strong routine directing the spatial extend of the activity. Nevertheless, the spatial identity of the individual is much larger and all the participants constructed their spatial identity in a larger context. **(cont on next page)**



UrbanDiary Basel

The UrbanDiary Basel project followed the same setup as the London version. In this second study the technical equipment was extended to include a set of new GPS devices. The new models were iGotU GT-120. These are simple trackers without any display. They were used in automatic mode, leaving them on constantly. The participants did not have to manage the device other than charging it over night. This did simplify the handling for participants; however, this practice puts more pressure on the post processing with a lot of recorded noise. Basel is compared to London a much smaller setting. Not in terms of sample, but in terms of the physical size of the city. Basel only has about 170,000 inhabitants, compared with seven million for London. Basel has in addition again about the same number of commuter traveling into the city on a daily basis. The scale differences are striking, also on other levels, what is a regular commute is completely different. It might be on average one hour for Londoner, but is probably stretched for Baslers if it is thirty minutes. As a consequence, work and leisure journeys do

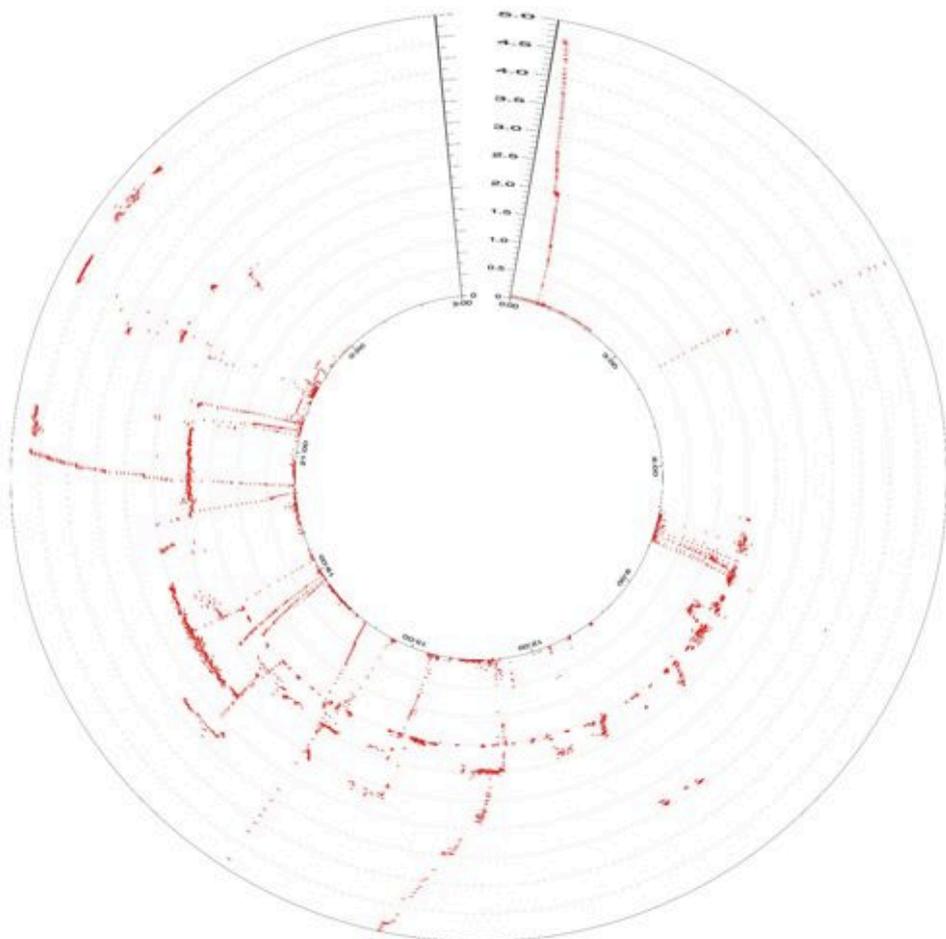
tend to look similar in Basel. However there are a lot of similarities too. Foremost the extension of the direct and persistent interaction in the urban realm is very much directed and selective. There is in both cases a strong local activity around the 'known' territory.

Even though the setting is restricted physically in size all the participants' records show the very characteristically individually defined perspective on the city. There is a clear field of activity, expanding contracting from the home location, building on work location to expand to a number of additional venues of activity. The strength of local ties was surprising to emerge as such a clear characteristic. Most likely because the Basel setting is smaller in size the pattern is more obvious. However, a detailed comparison between London and Basel shows, these patterns are very similar, based on larger distances.

For the visualization the tracks were visualised as time-distance graphs. In this

representation the time is plotted against the distance traveled. Since we are expecting these repetitive pattern or leaving home in the morning to go to work and returning back home in the evening the time-distance graph beautifully captures this. Of course we have to deal with a number of artifacts and a lot of noise, since the 'perfect' workday is predictably unusual. This applies especially to the activities after work. The morning commute is more precisely defined with a strong routine, where as the evening commute is more flexible and regularly accommodates changes.

The comparison study is very helpful and provides insight and opens avenues for additional investigations. Especially from a location or spatial perspective it makes sense to change only the context but not the study setup, e.g. sample or technique. Both datasets will be further investigated and expanded upon especially in regards of a comparison between the two locations to learn more about the role the context plays.



The 2011 Annual Meeting of the International Society of Behavioural Nutrition and Physical Activity will take place in the Melbourne Exhibition and Convention Centre, 15-18 June.

The organisers have kindly provided a room for GPS-HRN members to meet during the conference. We will meet at 12:30 on Thursday in Room 103.

While the agenda will be kept informal, we intend to cover the future of the network (including a formal structure), potential collaborative opportunities, and the possibility of establishing a shared resource for collating members' current activities. There will be plenty of time to meet fellow members and discuss our common interests.

If you would like more information about the meeting, or want to add an item to the agenda, please contact Scott Duncan (scott.duncan@aut.ac.nz) by Friday June 10.

We hope to see you there!

Research Profile



**Centre for Physical
Activity and Nutrition**

**Auckland University of
Technology**

www.cpan.aut.ac.nz

The Centre for Physical Activity and Nutrition (CPAN) is a multi-disciplinary research group specialising in the assessment, prevention, and treatment of lifestyle-related diseases across the lifespan. Our GPS-HRN members are Prof Grant Schofield (Director), Dr Scott Duncan (Associate Director), Dr Melody Oliver, Dr Hannah Badland (also with UCL), Chelsea Drumheller, and Julie Martin. We have several GPS-related studies either underway or upcoming, most in collaboration with other research centres.

Free-range kids

Over the past few decades, we have seen a dramatic reduction in the time and distance children are allowed to roam independently. The primary aim of this project is to investigate the intergenerational differences in the current and historical independent mobility of 10-12-year-old New Zealand children, their parents and their grandparents. Accelerometry, GPS, and GIS will be used to characterise the roaming behaviours of participating children. A secondary aim is to examine the associations among participants' physical

activity, diet, body composition, and several biomarkers of chronic disease.

PLAY

The PLAY project is an intervention aimed at improving the number and quality of play spaces in 16 New Zealand primary schools. A key focus is the introduction of more managed risk and interaction with nature into the play activities of our children. Of the total sample of 800 children who will wear accelerometers for seven days, 200 will wear GPS units during school breaks to observe changes in the usage of play spaces. This research is being conducted in collaboration with the University of Otago (lead).

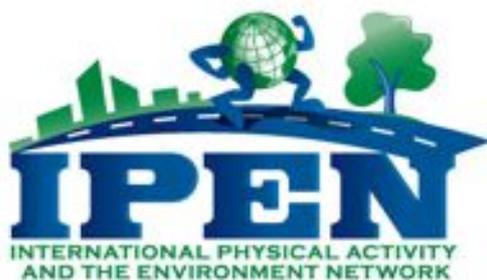
Sensecam

The use of environmental photography and SenseCam are increasingly being seen as valuable methods to elicit objective environmental information related to journeys. These data may be integrated with accelerometer and GPS data within GIS databases to enable the collective exploration of physical activity profiles, physical activity locations, GIS-derived environmental features, and aesthetic and contextual environmental features that would not otherwise be captured within a GIS database. This research investigates the utility of this combined methods approach to examine environmental factors associated with active transportation in adults. Participants will wear Actical accelerometers at the waist, a wrist-worn Garmin 205 Forerunner GPS unit, and a SenseCam monitor on a lanyard around the neck for all journeys (active and motorised) taken over four consecutive days. This

research is being conducted in collaboration with colleagues at the University of Oxford (lead), University College London, and Massey University.

Kids in the City

The Kids in the City study seeks to understand how the physical design and residential density of urban neighbourhoods in higher deprivation areas can influence the physical activity and independent mobility in resident children aged 9-11 years (n=150). The study uses a mixed methods approach, combining a cross-sectional multi-level (child, family, school neighbourhood) design to investigate associations between neighbourhood environment attributes (GIS, SPACES, NZ-POST), children's independent mobility (BT-Q1000/Q1000X GPS, travel diary) and physical activity (Actical accelerometer) over seven consecutive days. The research is being conducted in collaboration with Massey University (lead), the University of Auckland, and University College London.



IPEN was launched by Professor Jim Sallis (USA), Dr Ilse DeBourdeaudhuij (Belgium) and Professor Neville Owen (Australia) at the International Congress of Behavioral Medicine in Mainz Germany in August 2004.

Physical activity habits are determined by multiple levels of influence – personal, family, social, environmental, economic and other factors. Ecological models of health behaviour have been used to synthesize research at these different levels, and to

focus attention on relationships of particular physical activities with specific attributes of physical environments, including the built environment.

While physical activity environments will vary within countries, the greatest and most informative sources of variation in the relationships of environmental attributes with physical activity are likely to be between countries. The IPEN initiative seeks to stimulate, inform, and support systematic and rigorous studies of physical activity and the environment, in as many countries as possible.

Please contact Jacqueline Kerr (jkerr@ucsd.edu) or Nicole Bracy (nbracy@projects.sdsu.edu) if you would like more information.

www.ipenproject.org



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